The Files 29 August 1956

25X1A9a [redacted]

25X1A5a1 Visit to [redacted]

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1. On August 23, 1956 a meeting was held in the [redacted] Laboratory, Advanced Circuit Section, to discuss the subject contract. Present were:

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2. The work currently in progress demonstrates that the program emphasis is being correctly applied to solid state devices without over emphasis of circuit applications. This trip report will present the operating principles of some of the components being investigated and these operating principles will not be repeated in future trip reports.

3. Magneto Resistive Amplifier.

Indium antimonide and certain related compounds exhibit the property of changing resistance with variation of a magnetic field in which they are placed. In an amplifier as shown in Figure 1 the carriers drifting in response to an electrostatic field are deflected to one side by the magnetic field. Mobility is higher at the center of a conductor than towards the edge and under a high magnetic field more carriers will be forced to the edge increasing the overall resistance. Such a device could be expected to deliver up to 10 watts with an amplification of 20 db. The present problem is that the material is very brittle at the thicknesses required by a small magnetic air gap (.015 inch). Present methods of attack on this problem will be to use indium antimonide drawn from a single crystal to avoid the weakness inherent at crystal boundries and the use of thin coatings of N material on A P base.

4. Incremental Transfluxors.

If square loop Ferrite material is constructed in the shape shown in Figure 2, the core surrounding each hole may be saturated in increments leaving the balance of the material unsaturated. Thus a pulse on winding "c" may saturate the shaded portion shown, decreasing the unsaturated core area to winding "d" of the oscillator. The decreased core area would change the inductance of winding "d" and therefore the resonant frequency of the tuned circuit. Such a device would make it possible to tune a receiver by a series of pulses sent from the transmitter. Core I serves as a limiter limiting the amplitude of incoming pulses to that possible by transformed action before core I is itself driven into saturation. Such a device has been produced which allowed the resonant circuit to be tuned by pulses from one megacycle to 800 KC in 40 discrete steps (tuned in increments by 40 pulses).

5. Ceramic Resonators.

Barium titanate magnetostrictive filters have an equivalent circuit similar to a crystal (shown in Figure 3). It is apparent that such a circuit could be used as a series resonant circuit of the series IF amplifier described in the last trip report. Such a circuit appears in Figure 4. Physically the resonator is a very thin sheet approximately $\frac{1}{4}$ by $\frac{1}{4}$ inch. Current development is directed at making the barium titanate less temperature sensitive. [redacted] stated that the 25X1A5a1
25X1A5a1 decision as to whether [redacted] will market barium titanate as 455 KC IF strip filters, will be made within six months. As a filter the barium titanate will have approximately the same bandwidth and insertion loss as the Collins Mechanical Filter but will be considerably cheaper and individual filter plates will be electrical coupled rather than mechanically coupled.

6. Photoluminescent Devices.

If an electroluminescent phosphor is arranged with a photo conductor as shown in Figure 5, amplification can result. The principle of operation is that the voltage across the input terminals causes the electroluminescent phosphor to give off light which controls the resisitivity of the photo conductor. Figure 6 shows a barium titanate magnetostrictive filter restrained as shown. If the left hand half is connected to a 500 KC IF input the whole crystal will vibrate and the vibration on the right hand half causes electric charges to be produced in accordance with the stresses in the crystal. If the right hand half is now coated with photoluminescent material the charges will cause light to be given off which can be picked up by the photo conductor. Such an arrangement can theoretically amplify and moreover the photo conductor will produce a rectified current. If the photo conductor is chosen with a response characteristic which cannot follow the individual pulses of light but only averages, we have in a single device an IF frequency filter, an amplifier, a detector, and the audo-filter associated with the detector.

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OC-E/R&D-EP/TGW:jac (29 August 1956)

cc: Monthly Report (2)
R&D Subject File
Lab
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